

# Habitat Digitizer Extension

The Habitat Digitizer Extension to ArcView 3.1 was designed to use a hierarchical classification scheme to delineate habitats by visually interpreting georeferenced images such as aerial photographs, satellite images, and side scan sonar. The extension allows users to create custom classification schemes and rapidly delineate and attribute polygons using simple menus. Originally, the extension was created to classify tropical marine habitats. However, the extension now allows new hierarchical classification schemes to be easily created, modified, and saved for use on future mapping projects. There are several advantages to using classification schemes with a hierarchical structure including: the detail of habitat categories can be expanded or collapsed to suit user needs, the thematic accuracy of each category/hierarchical level can be determined, and additional categories can be easily added or deleted at any level of the scheme to suit user needs. The classification scheme included with this extension (*coral.hcs*) was used to create the habitat shapefiles for the “Benthic Habitats of Puerto Rico and the U.S. Virgin Islands”.

The extension is available for download from the “Benthic Habitats of Puerto Rico and the U.S. Virgin Islands CD-ROM” and also over the internet at <http://biogeo.nos.noaa.gov/benthicmap/caribbean>. The extension and accessory files are available in the “Habitat\_Digitizer.zip” folder. This folder contains three files including:

<i>Habitat.avx</i>	the extension
<i>Coral.hcs</i>	a classification scheme for tropical marine habitats
<i>Coral.avl</i>	an example legend for the coral.hcs classification scheme

## Hardware and Software Requirements

The Habitat Digitizer extension is compatible with ArcView 3.1 and requires hardware similar to that recommended for proper operation of ArcView. Additional memory may enhance performance for handling image files, which in most cases are quite large. The appropriate Image Support extension (TIFF, JPEG, etc.) is required depending on the format of the image files used. The Image Analyst extension is not necessary but is also recommended to facilitate manipulation of image brightness, contrast, and color balance.

## Getting started

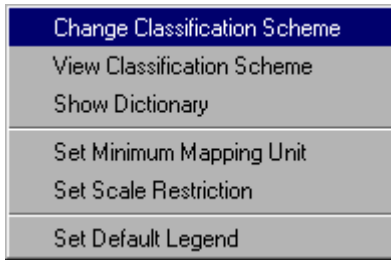
To begin using Habitat Digitizer, save the *habitat.avx* file in either ArcView’s Ext32 directory or the USEREXT directory. The *coral.hcs* and *coral.avl* files can be saved anywhere, but preferably, they should be placed in the working directory of the project.

After starting ArcView, load the Habitat Digitizer Extension (and any other desired extensions) by selecting “File/Extensions...” and click on the check box next to the Habitat Digitizer Extension in the “Available Extensions” list. Click OK to install the extension. If a project already exists that used the Habitat Digitizer Extension, opening the project will automatically load the extension.

## Setting the Projection Parameters for the Image Data:

The Habitat Digitizer allows users to specify a Minimum Mapping Unit (MMU), digitizing scale, and offers several other spatial functions that require the View’s projection and Map Unit’s to be set properly. The projection properties of the View must be set to those of the image data from which habitats are being interpreted. Once the View’s projection is set properly, shapefiles created using Habitat Digitizer will be unprojected (in decimal degrees). To set the projection properties, select “View/Properties” and set the Map and Distance Units as well as the Projection information of the image. If this information is not set, the shapefile will be created in the projection coordinates of the image files (not in decimal degrees) and the MMU, scale restriction, and other spatial functions of the extension will not work.

## *The Habitat Digitizer Menu*



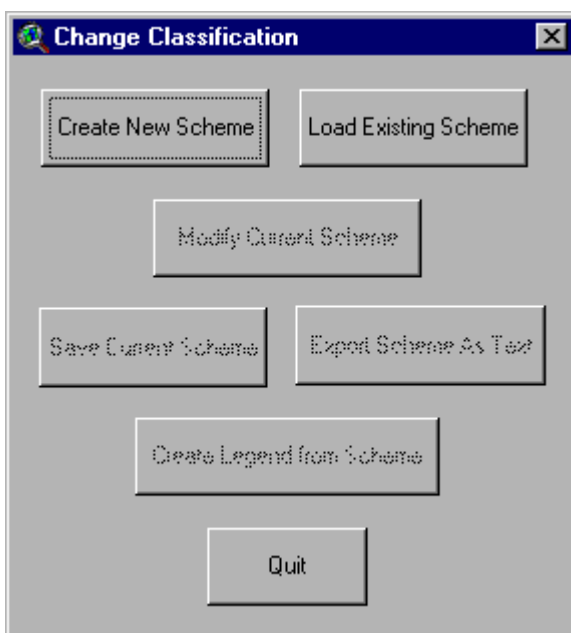
Once the Habitat Digitizer Extension has been activated a “Habitat Digitizer” pull-down menu and digitizing tools which control the functions of the extension will appear on the ArcView toolbar. Beginning with the process of creating and loading classification schemes, a detailed description and instructions for each function in the extension are provided in subsequent sections.

## *Creating a new classification scheme*

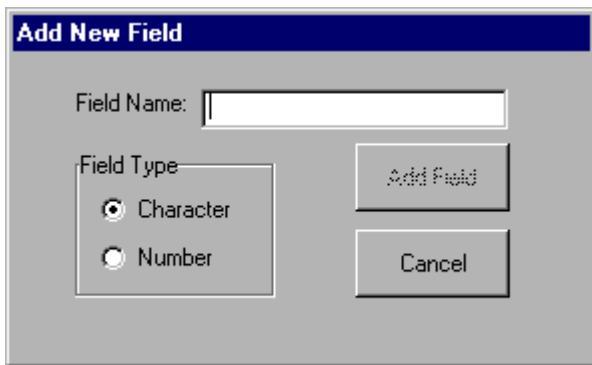
Unless an existing classification scheme is used, a new scheme must first be created to use the extension. Before creating a new scheme using the dialogs of the extension it may be useful to sketch the scheme out on paper to ensure that all fields and categories are entered properly. An example scheme framework is provided in Fig.1 to assist with this process.

Figure 1.

<i>Fieldname 1</i>	<i>Fieldname 2</i>	<i>Fieldname 3</i>	<i>Fieldname 4</i>	<i>UniqueID</i>
<b>Category 1</b>	<b>Subcategory 1</b>	<b>Subcategory 1</b>	<b>(empty)</b>	<b>111</b>
		<b>Subcategory 2</b>		<b>112</b>
	<b>Subcategory 2</b>	<b>Subcategory 1</b>		<b>121</b>
		<b>Subcategory 2</b>		<b>122</b>
<b>Category 2</b>	<b>Subcategory 1</b>	<b>Subcategory 1</b>		<b>221</b>
		<b>Subcategory 2</b>		<b>222</b>
	<b>Subcategory 2</b>			<b>22</b>
<b>Category 3</b>	<b>Subcategory 1</b>			<b>31</b>
	<b>Subcategory 2</b>			<b>32</b>



To create the new scheme using the extension, select “Habitat Digitizer/Change Classification Scheme” and in the dialog box, select “Create New Scheme”. Type in the name of the new classification scheme in the message box and click “Okay”. Until a scheme has been either created or loaded, the other options in this dialog will be unavailable.



**Add New Field**

Field Name:

Field Type

☒ Character

☐ Number

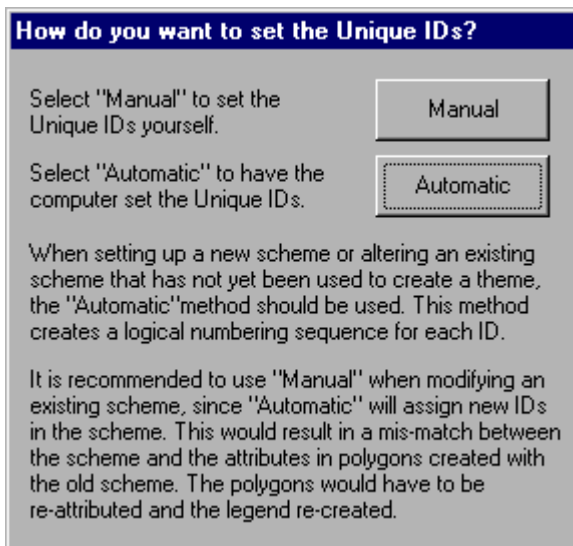
Add Field

Cancel

In the “Add New Field” dialog, selecting “Cancel” will end the creation process without creating a scheme. Once the first field name has been added, this button is replaced with the “Finished” button, which will complete the field naming process and go to the next step in creating the scheme. First, type in the field name for the most general (Fieldname 1 in Fig. 1) hierarchical level in the new classification scheme. Field names can only be 10 characters long. Select whether the field will be character or numeric and select “Add Field”.

Add additional field names in the order of the

classification hierarchy. A fieldname must be entered for every level in the hierarchy. It may be desirable to add a couple of extra fields to act as placeholders in case any additional unforeseen levels in the hierarchy are required at a later time. Select “Finished” to proceed to the next step once all the field names have been entered. Once “Finished” is selected, no additional fields may be added to the classification scheme. Also, note that a field named “UniqueID” will be automatically added once “Finished” is selected.



**How do you want to set the Unique IDs?**

Select "Manual" to set the Unique IDs yourself.

Select "Automatic" to have the computer set the Unique IDs.

Manual

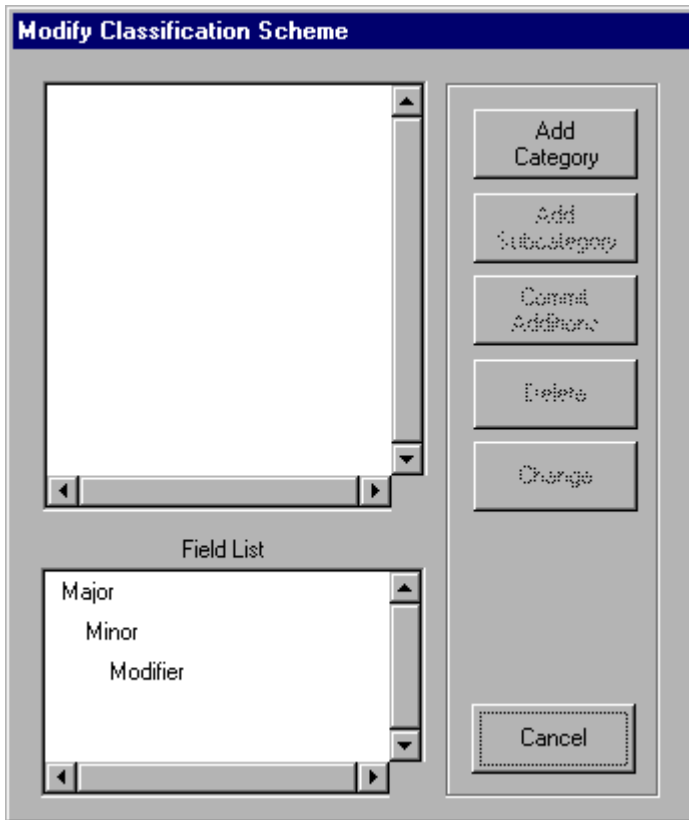
Automatic

When setting up a new scheme or altering an existing scheme that has not yet been used to create a theme, the "Automatic" method should be used. This method creates a logical numbering sequence for each ID.

It is recommended to use "Manual" when modifying an existing scheme, since "Automatic" will assign new IDs in the scheme. This would result in a mis-match between the scheme and the attributes in polygons created with the old scheme. The polygons would have to be re-attributed and the legend re-created.

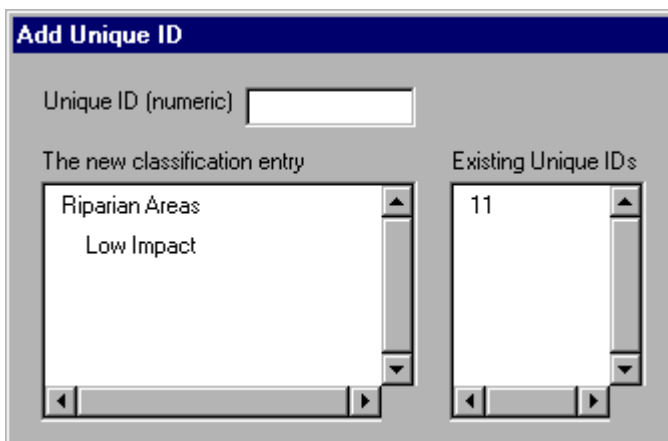
The “UniqueID” field is used by the extension to identify each possible combination of hierarchical categories with one unique number. UniqueID’s are used by ArcView to generate polygon attributes and assign the legend. The dialog at left sets the method of how the uniqueIDs will be assigned. When setting up a new scheme or altering an existing scheme that has not yet been used to create a theme, the “Automatic” method should be used. The “Automatic” method creates a logical numbering sequence for each uniqueID. However, if a scheme that has already been used to create a theme is modified, the “Manual” method should be used. If “Automatic” were used, new uniqueID’s would be assigned to the scheme creating a mis-match between the ID’s of the new scheme and those of the polygons attributed using the old scheme.

In the “Modify Classification Scheme” dialog, categories and subcategories can be added to a new or existing classification scheme. Begin by adding a category at the most general level in the classification hierarchy (Category 1 in Fig. 1). Click “Add Category”, type in the category name and click “Okay”.



Additional categories at this level in the hierarchy can be added in this way. Adding a category at this level will activate the “Add Subcategory” button. Subcategories are added within individual categories by selecting the category of interest then clicking “Add Subcategory” and completing the dialog boxes. If the uniqueID’s are to be assigned using the “Automatic” option (previous dialog), the “Delete” and “Change” buttons can be used to adjust category names and locations in the hierarchy using this dialogue. In the “Automatic” method, clicking the “Finished” button will assign a uniqueID to each classification combination. If “Manual” was selected, the “Delete” and “Change” buttons will not be activated until the uniqueID’s for each of the categories and subcategories have been added (next dialog). To add unique ID’s manually, click the “Commit Unique ID” button after all categories and subcategories have been added and complete the “Add Unique ID” dialogue box as described below. Once the uniqueID’s have been assigned the

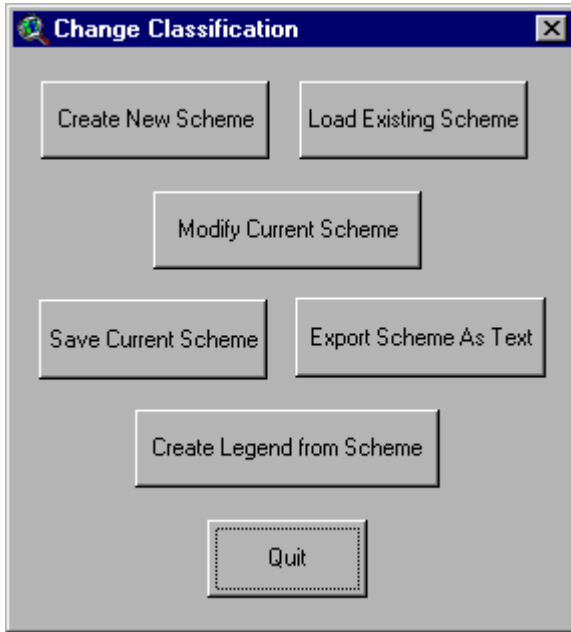
“Delete” and “Change” buttons will be activated. If the “Cancel” button is selected, the scheme creation process will be ended without creating a scheme.



If “Manual” was selected for assigning uniqueID’s, the “Add Unique ID” dialog will appear after selecting “Commit Additions”. A unique numeric identifier must be entered for each possible combination of classifications in the hierarchy. The “Existing Unique IDs” list shows which numbers are already used in the scheme. Duplicate numbers cannot be added. See Figure 1 or the sample coral classification scheme and legend that is included with the extension to get suggestions on how to assign uniqueID’s. Once uniqueID’s are set through either the “Manual” or “Automatic” method and

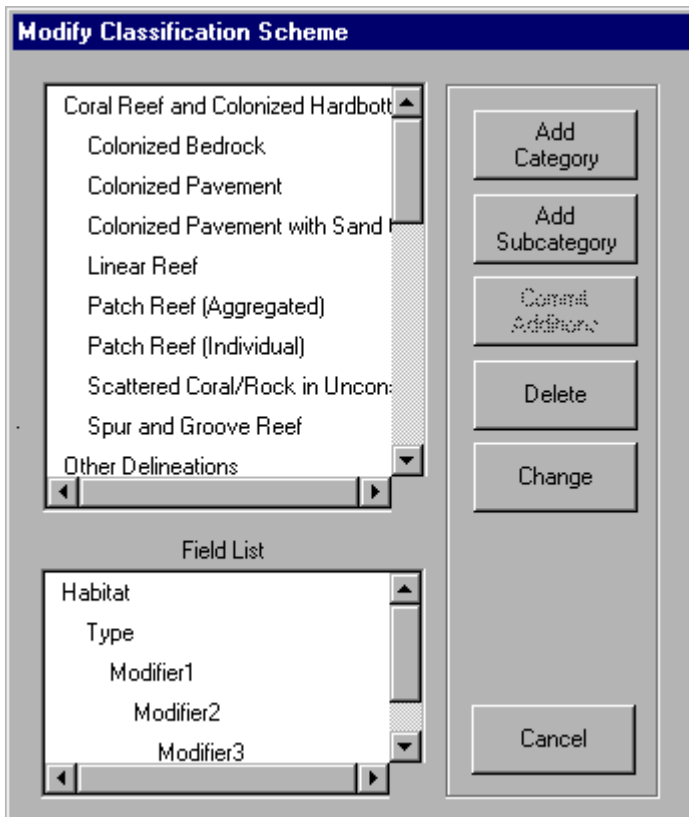
“Finished” is selected in the “Modify Classification Scheme” dialog, the new scheme can be saved and used to digitize habitats.

### *Saving and Re-Loading and Creating Legends*



Once finished creating or modifying a scheme, save the scheme to a file by selecting "Save Current Scheme" in the "Change Classification" dialog box. The file will be saved as a \*.hcs (habitat classification scheme) file. To access this scheme select "Load Existing Scheme" in the "Change Classification" dialog box. A file selection dialog will open showing only the \*.hcs files. Additional options that can be used at this time include the "Export Scheme As Text" button which will create a text file showing the hierarchical structure of the scheme, and the "Create Legend from Scheme" button which will make a legend that contains each uniqueID and its attributes. Legend labels will have all of the categories in the classification hierarchy concatenated into one string. Colors will be randomly selected and an additional "Unclassified" category will be added with a uniqueID of 0.

### *Editing an existing classification scheme*

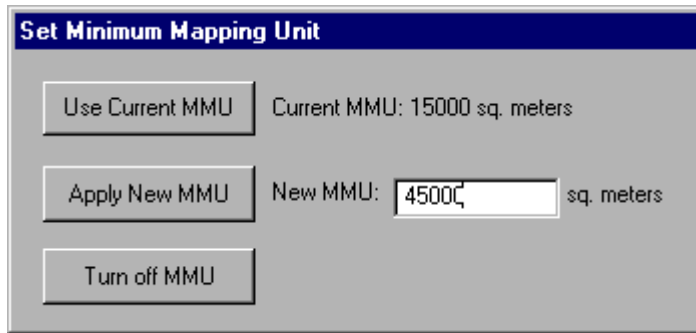


Select "Modify Current Scheme" in the "Change Classification" dialog box. After selecting the method of assigning the uniqueID (and in this case, using Manual is recommended), the "Modify Classification Scheme" dialog will appear. Follow the same instructions in "Creating a new scheme" to edit this scheme using this dialog.

## ***Digitizing Restrictions***

### **Minimum Mapping Unit**

Depending on the quality of aerial images used and the specific goals of the project, it will probably be desirable to limit the minimum size of the features that are delineated. For example, poor image resolution may preclude the interpretation of features smaller than some minimum size threshold. Other features, while interpretable in the imagery, may simply be too small and therefore beyond the



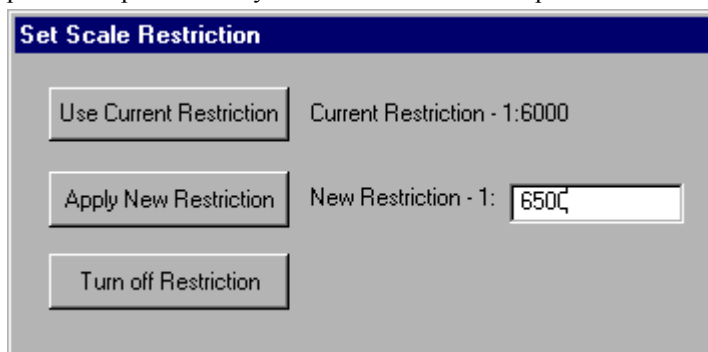
The dialog box titled "Set Minimum Mapping Unit" has a blue header. It contains three buttons: "Use Current MMU", "Apply New MMU", and "Turn off MMU". To the right of the buttons, it displays "Current MMU: 15000 sq. meters" and "New MMU: 45000 sq. meters". The text "45000" is entered in a text box next to "New MMU".

scope or goals of the desired map product. To limit the size of the features that can be digitized in the habitat map, a minimum mapping unit (MMU) can be set in Habitat Digitizer. Features must be larger than the MMU to be included in the habitat map. Set the MMU restriction by selecting "Habitat Digitizer/Set Minimum Mapping Unit". If the view's Map and Distance units are

set, a dialog will appear showing the current MMU. Enter the desired numerical MMU into the text box and select "Apply New MMU". If a satisfactory MMU has already been set, "Use Current MMU" will close the dialog without changing the MMU. If the area of a newly digitized polygon is below the MMU, a message box will ask whether the polygon should be added to the theme. If no MMU restriction is desired, "Habitat Digitizer/Set Minimum Mapping Unit/Turn off MMU" will allow digitizing polygons with no size restriction.

### **Scale Restriction**

It is possible to adjust the scale of the image files as they appear on the computer monitor. For example, the scale of hard copy photographs used for mapping may be 1:48000, however the actual photo interpretation may be conducted on the computer monitor while zoomed in on the scanned



The dialog box titled "Set Scale Restriction" has a blue header. It contains three buttons: "Use Current Restriction", "Apply New Restriction", and "Turn off Restriction". To the right of the buttons, it displays "Current Restriction - 1:6000" and "New Restriction - 1: 6500". The text "6500" is entered in a text box next to "New Restriction - 1:". The text "1:" is also present before the text box.


photographs at a much larger scale (e.g. 1:6000). It may be desirable to conduct all polygon delineation at the same scale, such that all polygons have the same level of detail. Set the scale restriction by selecting "Habitat Digitizer/Set Scale Restriction". Enter a number in the text box and select "Apply New Restriction". If digitizing is attempted while a scale restriction


is in place and the view is not at the specified scale, a message box will offer to zoom the view to the proper scale. If "No" is selected, a polygon cannot be digitized. If a scale restriction is not desired, use "Habitat Digitizer/Set Scale Restriction/Turn off Restriction" to allow digitizing at any scale.

## ***Creating a theme and using the digitizing tools***

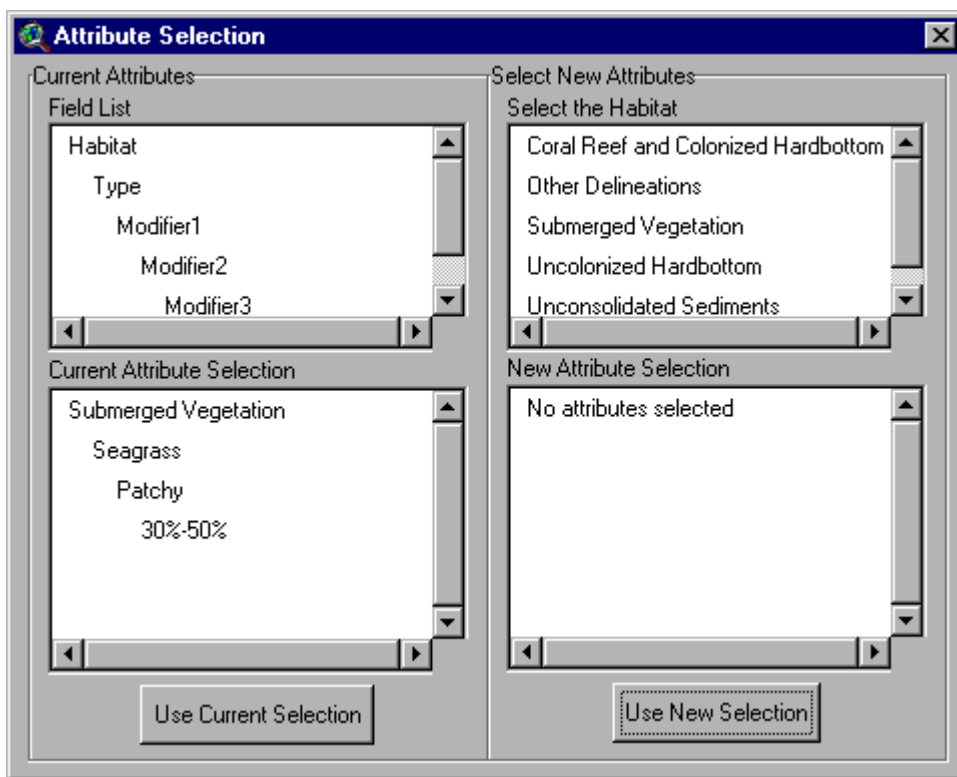


Once a classification scheme has been loaded, this button will create an empty theme with the appropriate fields. If a default legend has not been created using "Habitat Digitizer/Set Default Legend" or the "Change Classification" dialog, a dialog will appear to select a legend file. A second message box will appear asking if this legend should be made the default legend for all new themes created using this classification scheme.


 To start digitizing a new polygon, select this tool and trace the feature of interest by clicking around its perimeter with the mouse. A double click closes each new polygon. If a polygon is digitized inside or completely around an existing polygon, “donut” and “donut hole” polygons will be formed. Once the polygon is complete, a message box will allow the classification to be set as outlined below.

 Use this tool to add a polygon adjacent to an existing polygon. To create a polygon using this tool, start tracing a line inside of the adjacent polygon and end the line by clicking twice inside of the adjacent polygon. This tool will not work when attempting to digitize a polygon inside of another polygon (use the Split tool to do that). The scale restriction and MMU also apply to this tool. If several polygons are created with a single line and some are below the MMU, a warning message will appear. If “No” is selected on the warning message only the polygons that fall below the MMU will be removed.

Once polygons are completed using the Add and Append tools, a dialog will appear to assign the classification attributes.



The “Field List” displays the hierarchical structure of the fields in the scheme. “Current Attribute Selection” shows the classification type, if any, currently selected. Either select “Use Current Selection” or select a new classification type by clicking through the desired classification attributes in the “Select New Attributes” window. As new attributes are selected they will be displayed in the “New Attribute Selection” window. The “Use New Selection” button will be activated when the attribute in the lowest hierarchical level for the new classification is selected.

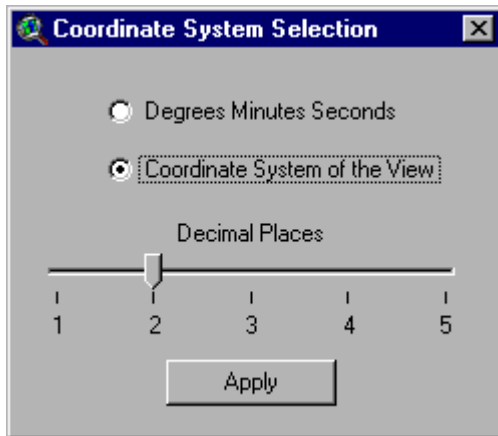
 This tool splits one or more polygons into several polygons. All of the attribute information for the resulting polygons will be the same as the original(s) but can be changed as explained below under “Tools from the Right Mouse Button”. Please note that due to a bug in ArcView, this tool sporadically works when attempting to split along the inside border of a donut polygon. The scale restriction and MMU also apply to this tool. If several polygons are split and some of the resulting polygons fall below the MMU, choosing “No” will remove the entire line and merge the split polygons back together.



This button will place a MMU sized red box on the view by clicking the button and then clicking the View at the desired location. This box allows users to estimate the size of features in the imagery relative to the MMU. This box will disappear when panning, moving from the current extent by zooming in or out, or after completing a polygon. To use this feature while adding a new polygon see “Tools from the Right Mouse Button” below.



This button brings up a dialog to display the cursor's x/y position in the upper right hand corner of the ArcView window in either the coordinate system of the view (default) showing from 1-5 significant digits, or in degrees, minutes, and seconds. This requires that the view's projection be set and the map units specified.



### ***Tools from the Right Mouse Button***

Click and hold down the right mouse button to view a list of additional tools and options:

**“Panning”** will recenter the display over the spot where the right mouse button was clicked. This is useful while digitizing large polygons that don't fit entirely within the view frame.

**“Show attributes”** will display a message box showing the habitat attributes for the currently selected polygon.

**“Change habitat attribute”** will allow the user to change the habitat attributes for existing polygons that are selected.

**“MMU Box”** places an MMU box on the View where the right mouse button was clicked (can be added while digitizing a polygon).

**“Polygon Area”** shows the area of a selected polygon.